Rate of Programs Affected by Resident Attrition and Program Factors Associated With Attrition in Emergency Medicine

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ABSTRACT

Background Resident attrition negatively affects residents and programs. The incidence of attrition in emergency medicine (EM) and program-specific factors associated with attrition remain unclear.

Objective We quantified the percentage of EM residencies affected by attrition between 2007 and 2016 and identified program-specific factors associated with attrition.

Methods We performed a retrospective analysis of data derived from the American Medical Association National Graduate Medical Education Census. We defined attrition as any postgraduate who left their residency training program prior to completion. We calculated the percentage of residency programs that experienced attrition and the overall incidence of attrition. We used Fisher's exact tests, Wilcoxon rank sum tests, and *t* tests, as well as multivariable logistic regression, to identify program-specific factors associated with attrition.

Results Between 2007 and 2016, 139 EM residency programs (82%) experienced attrition of at least 1 resident. An average of 23% of EM training programs experienced attrition annually. The incidence of EM resident attrition averaged 0.85% per year. Program-specific factors associated with attrition include 4-year residencies ($P = .031$), programs with medium class size ($P = .0003$), more female residents ($P = .002$), and more female faculty ($P = .003$). After analysis, only medium class size (compared to small) was associated with attrition (odds ratio = 4.96, 95% confidence interval 1.65–14.91).

Conclusions Between 2007 and 2016, while the incidence of resident attrition in EM was low (< 1%), the majority of programs experienced resident attrition. Medium class size (7 to 12 residents) was the only program-specific factor associated with increased attrition.

Introduction

Resident attrition is a well-known issue within graduate medical education, but it has not been well-studied. The loss of a resident prior to completion of training can negatively affect fellow trainees and program leadership, may hinder future recruitment efforts, and may negatively affect patient care.[1–6] There are few studies within emergency medicine (EM) to shed light on the phenomenon, especially as it relates to the percentage of residency programs impacted and program-specific factors that are associated with resident attrition. The majority of existing data on residency attrition arises from other specialties, such as general surgery, obstetrics and gynecology (OB-GYN), and their surgical subspecialties,[2,3,7,8] which focus on attrition rates and resident-specific factors associated with attrition.

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Editor's Note: The online version of this article contains overall incidence of emergency medicine resident attrition by academic year and program-specific factors and resident attrition.

Our objectives were to quantify the percentage of EM residency programs affected by attrition and identify program-specific factors associated with attrition.

Methods

We performed a retrospective observational study of resident attrition in EM by analyzing resident census data provided by the American Medical Association National Graduate Medical Education Census.[9] Data were generated from a survey of EM program directors conducted by the Accreditation Council for Graduate Medical Education (ACGME) on an annual basis. We reviewed data for all categorical residents who entered ACGME-accredited EM programs between academic years 2007 and 2016.

We defined attrition as any resident at any postgraduate level who left their EM residency program for any reason (eg, transferred, withdrew, dismissed, took a leave of absence, or passed away) prior to completion of their training. The percentage of programs with any attrition was calculated as the

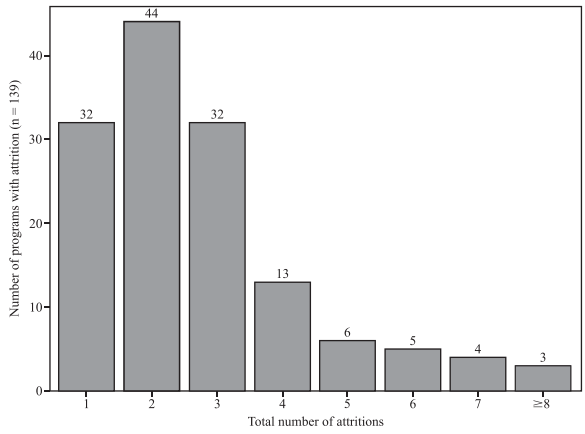

FIGURE 1
Number of Emergency Medicine Programs With Attrition

What was known and gap
Resident attrition is a recognized problem in graduate medical education, but how common it is in emergency medicine or what residency program factors increase its likelihood is unknown.

What is new
A retrospective analysis of data derived from the American Medical Association National Graduate Medical Education Census to find the percentage of residency programs that experienced program-specific factors associated with attrition.

Limitations
Data are self-reported and may be influenced by recall bias.

Bottom line
Medium class size was the only factor that significantly increased the likelihood of resident attrition in emergency medicine programs. Overall, nearly a quarter of EM programs experienced attrition each year.

percentage with at least one resident attrition during a given academic year. The incidence of attrition for EM was defined as the proportion of all residents who left their program in a given year when compared to the total number of residents in ACGME-accredited programs for that same year.

A Cochran-Armitage Test for Trend was used to identify any change in the rate of attrition over the years in the dataset. Descriptive statistics were produced for program-specific factors overall, then separately for programs that experienced any attrition from 2007 to 2016 and for those that experienced no attrition. Differences between these groups were calculated using Fisher's exact tests, Wilcoxon rank sum tests, and 2 independent sample *t* tests. Multivariable logistic regression was performed to model attrition on program length, class size, percentage of female residents, and percentage of full-time female faculty, where class sizes were defined as small (≤ 6 residents), medium (7 to 12 residents), or large (≥ 13 residents). We used SAS 9.4 (SAS Institute Inc, Cary, NC) to perform all data analysis and descriptive statistics.

Our Boston Medical Center Institutional Review Board approved this study as exempt.

Results

Between 2007 and 2016, 139 EM residency programs (82%) experienced the loss of at least 1 resident. Of this cohort, the majority of programs (78%, 108 of 139) experienced a loss of 1 to 3 residents, with few experiencing additional attrition (FIGURE 1).

An average of 23% (36 of 158) of all programs experienced attrition each year between 2007 and 2016. We found no positive or negative trend in the percentage of programs with attrition during our study period (2-sided *P* value = .25; TABLE 1).

The incidence of EM resident attrition across all ACGME-accredited EM programs was between 0.6% and 1.1%, with an average rate of 0.85% per year (provided as online supplemental material). Though the Cochrane-Armitage Test of Trend demonstrated a statistically significant decrease in EM resident attrition over the study period ($Z = 2.29$, $P = .022$), the negative Somers' D value (-0.001) suggests the change is negligible. FIGURE 2 shows the percentage of programs that experienced attrition and the percentage of residents who left their residency program for any reason.

Program-specific factors associated with attrition include 4-year residencies (97% versus 81%, $P = .031$), programs with medium or large class size (average of 7 to 12 or 13 or more residents per year, respectively; 90% versus 57%; $P = .0003$), more female residents (38% versus 32%, $P = .002$), and more full-time female faculty (30% versus 23%, $P = .003$). A list of factors associated with attrition is available as online supplemental material. After

TABLE 1
Programs With At Least 1 Resident Attrition by Academic Year

Academic Year	Programs (n)	Programs With Attrition, n (%)	95% Confidence Interval
2007–2008	146	32 (22)	15.9–29.3
2008–2009	148	38 (26)	19.3–33.3
2009–2010	153	34 (22)	16.3–29.5
2010–2011	155	45 (29)	22.4–36.6
2011–2012	158	43 (27)	20.9–34.7
2012–2013	160	29 (18)	12.9–24.9
2013–2014	163	28 (17)	12.1–23.8
2014–2015	167	33 (20)	14.4–26.5
2015–2016	168	41 (24)	18.5–31.5

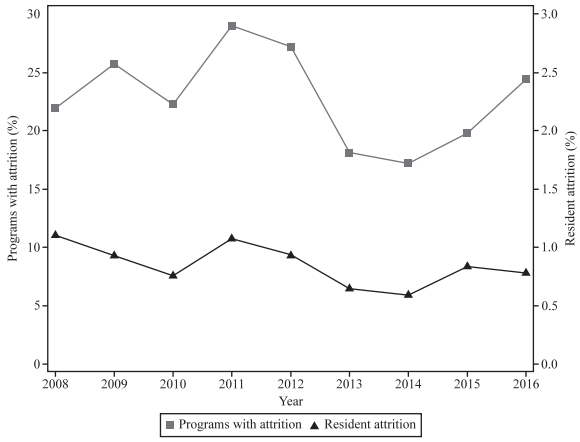

FIGURE 2
Percent of Programs With Attrition and Resident Attrition Rate

controlling for percentage of female residents and full-time female faculty, medium class size compared to small class size was the only remaining factor significantly associated with increased resident attrition (odds ratio = 4.96, 95% confidence interval 1.65–14.91). No other independent variables were significantly associated with increased odds of attrition in multivariable logistic regression analysis (TABLE 2).

We found no statistically significant association between resident attrition and program location by census region, urban-rural classification, program type (community-based versus university-based), average number of training sites, allopathic versus osteopathic training, percentage of residents who are international medical graduates versus US graduates, ratio of full-time to part-time faculty, hours per week on duty, and allowances for moonlighting or professional stipends (provided as online supplemental material).

Discussion

Between 2007 and 2016, 82% of EM residency programs experienced at least 1 resident attrition. For the majority the loss was 1 to 3 residents. Approximately a quarter of EM programs had at least 1 resident attrition per year. Our results reveal an average incidence of resident attrition in EM of 0.85% per year, consistent with other reports.[3,10] For comparison, studies have demonstrated an attrition rate among general surgery residents to be up to 26%.[8] A resident attrition rate of almost 7% was reported in the neurological surgery literature,[11] 4.2% in OB-GYN,[3] and 1.1% in ophthalmology.[12]

Changes in resident attrition over the study period appeared negligible, which is surprising given the large increases in ACGME-accredited EM training

TABLE 2
Multivariable Logistic Regression Model of Resident Attrition

Effect	Odds Ratio	95% Confidence Limits	
Class size: medium versus small	4.96	1.65	14.91
Class size: large versus small	3.18	0.83	12.17
Average % female residents	1.06	1.00	1.12
Average % female faculty	1.05	1.00	1.10

programs (15%) and trainee positions (10%), and the over 40% increase in the number of applicants choosing EM during this period. Despite the low risk of attrition on an individual resident level (< 1%), nearly a quarter of EM programs lost a resident from their program prematurely *each year*. Through this lens, one might argue that EM resident attrition is a significant problem. Furthermore, there is a dearth of existing literature to guide us on whether a certain rate of attrition is acceptable or concerning.

With regard to program-specific factors, current literature is scant. In a 2013 study, Sullivan et al reported that program location, specifically programs located outside the South (Northeast, Midwest, West), was associated with higher attrition.[13] In fact, studies have demonstrated that surgical residencies based in the Northeast experience higher attrition than programs in other regions of the country.[13,14] In our analysis of EM, there were no regional differences in the rate of resident attrition.

Yeo et al reported low attrition rates in surgery for male interns at small community programs who were white, non-Hispanic, and married, as well as female interns training at smaller academic programs.[14] In our study, the only program-specific factor associated with increased attrition after multivariate analysis was medium class size (average of 7–12 residents per year), as compared to small class size.

Recent work demonstrated that female EM residents had significantly higher attrition rates than their male colleagues.[10] In our study, while having more female residents or full-time female faculty were associated with attrition in bivariate analyses, the statistical significance disappeared in multivariate analysis.

Four-year program length, compared to 3-year program length, was associated with EM resident attrition. In the multivariable logistic regression analysis, program length was excluded; as there was only one 4-year program that did not experience attrition, convergence failure may have affected the analysis. Previous literature demonstrated that the majority of attrition occurs early in residency

training,[6–8,11,13] thus it is not yet clear that program length plays a role.

Our study is limited by the self-reported nature of the data from program directors, who may have been influenced by recall bias. Additionally, with more programs receiving accreditation and more data variables requested by ACGME over the years, different programs submitted varying amounts of data. Moreover, the seemingly arbitrary cutoffs for small, medium, and large average class sizes may affect our findings. Finally, despite the comprehensive nature of our database, the number of EM residency programs in our cohort is still considered small in terms of sample size. This limitation is exacerbated when we attempted to stratify by attrition status, which limits available statistical testing and power.

Moving forward, qualitative studies that include residents who leave programs, as well as those who considered leaving but did not, may add insights into strategies to minimize resident attrition.

Conclusions

In this study of attrition from the residency program perspective between 2007 and 2016, only medium class size versus small class size showed increased attrition. Overall, nearly a quarter of EM programs experienced attrition each year, although the average attrition rate was less than 1% per year and stable over the study period.

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